2. PROPOSED ACTION AND ALTERNATIVES

2.1 BACKGROUND

The NEPA of 1969 and the Council on Environmental Quality (CEQ) regulations implementing NEPA require that the environmental impacts of any proposed federal action be evaluated and considered in comparison to the impacts of various alternative actions. Alternatives available to DOE include (1) no action, (2) construction and operation of these actions at other locations at Jefferson Lab, (3) construction and operation of these actions at a location other than Jefferson Lab and (4) construction and operation of a facility using a technology different than Helios.

The proposed action evaluated herein will require additional DOE funding for construction and other DOE support for the ongoing maintenance and operation of the new structures and the new Helios machine. Looking far ahead, the Helios decommissioning is assessed in this EA. The new buildings themselves would be designed for long-term use, so decommissioning is not discussed in this document.

The following sections present a description of the proposed action and alternatives and a comparison of the impacts of each. Note that the proposed action incorporates all related activities identified when this proposal was initiated.

2.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is comprised of a series of building construction projects and the installation and operation of a synchrotron light source that, in combination, will provide important improvements to serve the existing Jefferson Lab facility. With this proposal, DOE intends to construct up to four major additions to CEBAF Center, the main facility administration building; three new single-story structures that include a storage building, a technical support building, and a refrigeration building, and a two-story structure, the FEL addition. The proposal includes installation and operation of a new synchrotron light source named Helios in the proposed FEL Addition. A location map of the Jefferson Lab site is provided as Figure 1. Figure 2 is a site map and includes the buildings proposed for construction in this EA. An aerial photograph of the site is provided as Figure 3.

All buildings will be linked with the site's current utility infrastructure. No new connections to offsite power and communications services are expected as the 40 MVA (megavolt amp) substation on the accelerator site has plenty of available capacity to meet the power needs of the proposed action. However, the on-site utility services will require major upgrades, in the form of new substations and underground ductwork and piping, to support these new structures and to operate the new synchrotron light source.

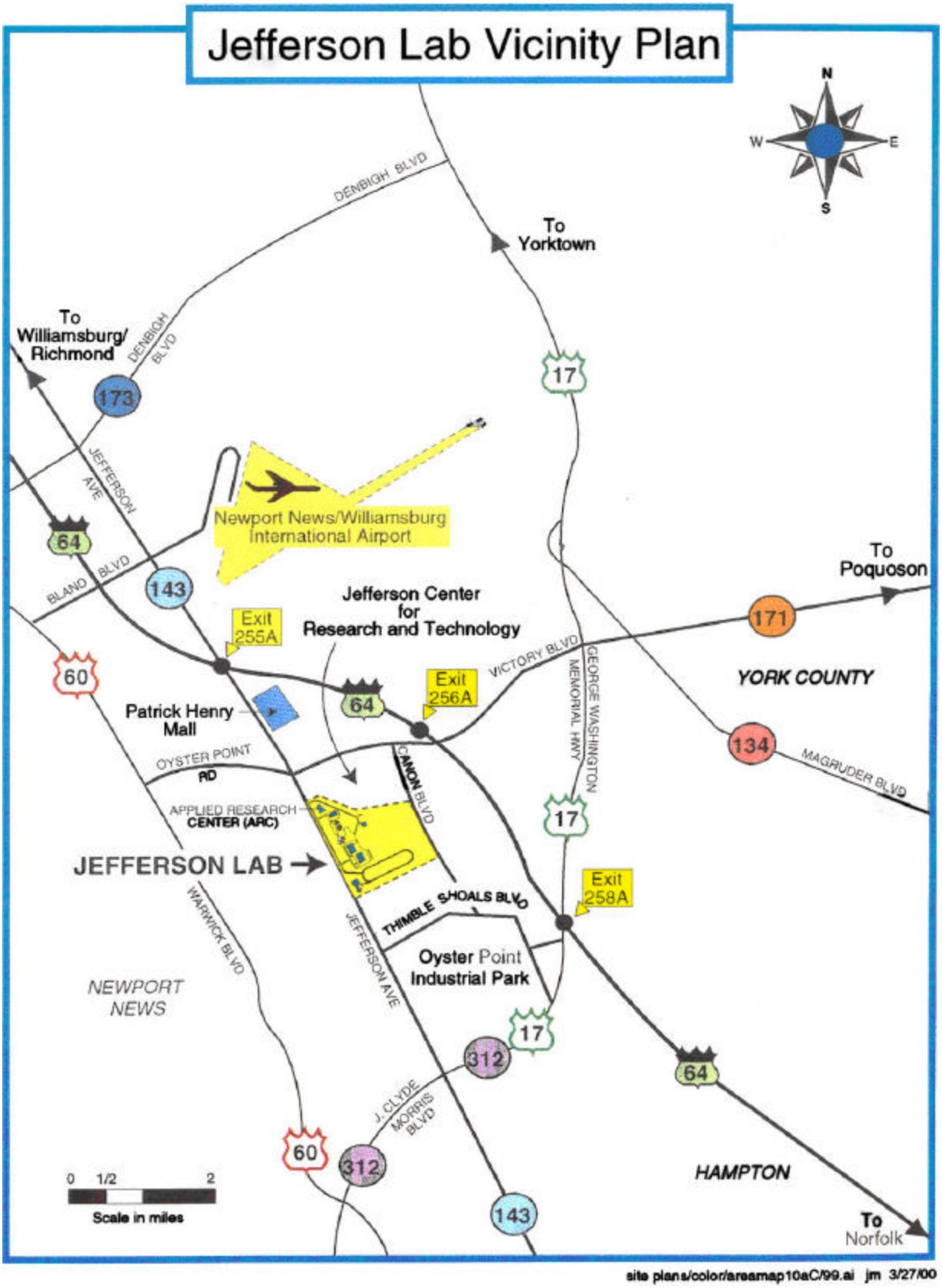

Figure 1 – Jefferson Lab Vicinity Plan

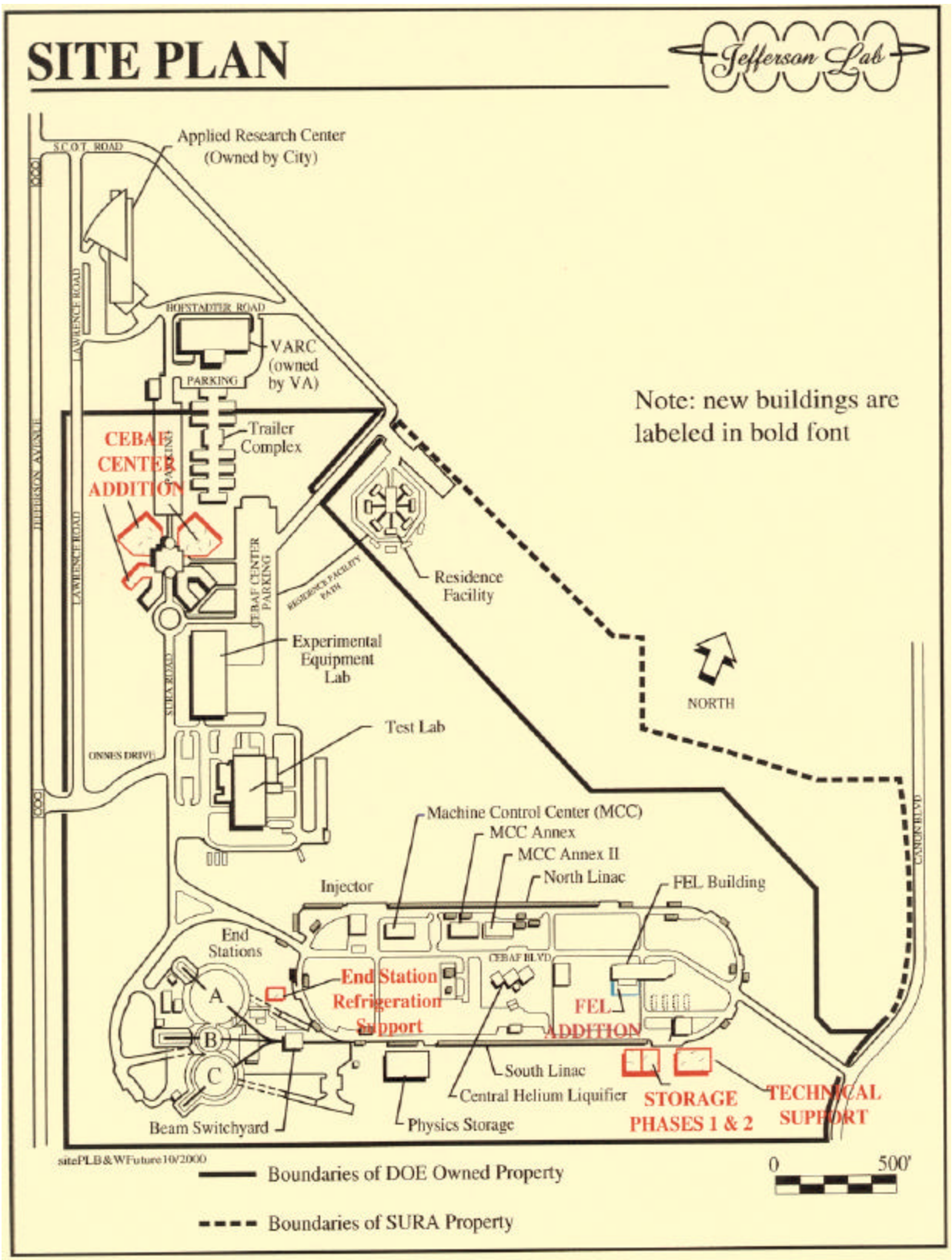

Figure 2 – Site Plan

Figure 3 - Site Aerial Photo (1998)

2.2.1 CEBAF Center Additions

DOE intends to construct up to four major two or three story additions to CEBAF Center, the main facility administration building. The total size of the four major additions, which would be accomplished in three or four phases, is about 151,000 sq. ft. (Phase 1 at 59,000 sq. ft., phase 2 at 57,000 sq. ft., phase 3 at 14,000 sq. ft., and phase 4, if needed, at 21,000 sq. ft.). Each of these additions will have two or three floors to match and complement the existing structure. About 81,000 sq. ft. of additional parking and associated access roads will be included in this portion of the project.

The four major additions will provide offices, additional computer center space, a library, a document control center, a copy center, additional conference rooms, an expanded kitchen and dining area, and larger auditorium. It is currently anticipated that the existing utilities will be upgraded to include another 1.5 MVA substation with its own natural gas backup generator. Other utilities and services will be provided through upgrades and extensions of existing utility networks. No major upgrades to existing site services are required to support the operation and maintenance of this greatly enlarged building. A small increase in staffing is foreseen to appropriately maintain this and the other new structures.

The grassed areas surrounding the existing building, as well as the wooded areas to the east, west, and north of the existing building, will be disturbed for the construction and associated parking for a total of about 232,000 sq. ft. As the construction will have a substantial effect on the local surface drainage, some additional perimeter areas (about 7,500 sq. ft.) may be disturbed but restored to provide drainage to account for the new impervious areas.

2.2.2 End Station Refrigeration Support Building

The End Station Refrigeration Support Building, about 3,500 sq. ft., will be built in an area to the northeast of Experimental Hall A in the vicinity of the existing End Station Refrigerator (ESR) Building, Building 102. It will be a one-story structure, with one high bay area and a pit to support cryogenic cooling equipment. The new refrigeration capacity is needed to support the site cryogenic refrigeration system in its attempt to meet the growing demands of the three experimental halls (Hall A, Hall B, and Hall C), which are also referred to as end stations. A new driveway and a local parking area to serve several vehicles will also be included.

An existing transformer will be relocated and replaced with two units sized at 5.0 and 1.5 MVA. The units will serve the new structure and the existing ESR Building. A cooling tower to support the expanded refrigeration capability is included in this proposal, thus is included in the total square footage noted below. Other utilities and services will be provided through upgrades and extensions of existing utility networks. No major upgrades to existing site services are required to support the operation and maintenance of this new building. Existing staff will primarily address the operation and maintenance of this structure and the equipment within.

The total area affected is about 5,000 sq. ft. There are no trees or wet areas, including storm channels, to be disturbed. As only a small surface area will be unavailable for stormwater retention, only minimal modification to the local storm channel system is expected.

2.2.3 Technical Support Building

The Technical Support Building will be about 16,000 sq. ft. and will be built on the south side of the South Access Building, Building 38. It will have one floor and be constructed to provide a machine shop and technical shop/office space. The machine shop will house the Cryogenics Fabrication Group. This project will disturb about 54,000 sq. ft. of land that includes its access ramp and about 25 additional

parking spaces and a material lay down area. Approximately 400 feet of the accelerator site's perimeter fence will need to be relocated about 20 feet outward to provide an adequate security clearance.

An existing spare 750 KVA (kilovolt amps) transformer will be relocated to this area and will serve this building and the new Accelerator Storage Building. The power and other utilities will be extended from an adjacent corridor that parallels the neighboring Building 2, so no major utility upgrade is anticipated to support the operation and maintenance of this new building. No increase in staffing is foreseen to appropriately maintain this structure.

This 54,000 sq. ft. proposed construction area is covered in grass and may require earth fill to level out the site. An additional approximately 8,000 sq. ft. area just outside the existing fence contains trees and vegetation that will be cleared as necessary to relocate the fence for security reasons. The remainder of the site to be disturbed contains no trees or wet areas, including storm channels. Moderate impact on the drainage area will result but only storm drainage in the immediate area will need to be modified.

2.2.4 Accelerator Site Storage Building

The Accelerator Site Storage Building is about 20,000 to 28,000 sq. ft. in area. It will be built in two phases and will be sited on the south side of the South Linac (LINear ACcelerator), Building 2. It will have one floor with an allowance for a possible mezzanine to be added in the future. It will disturb about 30,000 sq. ft. of land, including its access ramp, with no additional parking spaces needed. As noted above, about 400 feet of the accelerator site's perimeter fence will need to be relocated about 20 feet outward to provide an adequate security clearance.

Storage will include accelerator components awaiting reuse or installation, records, and other routine warehousing. Some of the materials may be slightly radioactive, but there will be no radioactive waste stored in the building. The power will be provided by way of the transformer mentioned under the Technical Support Building. The utilities will be extended from an adjacent utility corridor, along with those for the adjacent Technical Support Building. No major upgrades to existing site services are required to support the operation and maintenance of this new building. No increase in staffing is foreseen to appropriately maintain this structure.

The 30,000 sq. ft. construction area is covered in grass and also may require some earth fill. The area just outside the existing fence contains trees and vegetation that will be cleared as necessary for construction and security purposes. The remainder of the site to be disturbed contains no trees or wet areas, including storm channels. The local area drainage will be affected and will be addressed along with the construction of the proposed Storage Building.

2.2.5 FEL Addition and Operation of Helios

The FEL Addition will be about 130 feet by 90 feet (22,600 sq. ft. total) and will be added to the FEL Facility, Building 18. The addition will have 2 floors and is needed to support the FEL, Helios, and other Jefferson Lab activities. Total land disturbance is about 25,000 sq. ft. including a new driveway and about 14 additional parking spaces.

The addition will house a test cave area, a synchrotron area, a multi-use clean room, a large general purpose experimental area, about 5 user labs, a receiving area, and general storage. The utility services will be added in parallel to those serving the existing building. Bulk materials (e.g., soils, concrete) may be added to shielded areas as part of routine maintenance or installed in non-shielded areas to enhance Jefferson Lab's ALARA program for radiation protection.

A new 15 MVA transformer will be installed to service this new addition and the Helios machine. Utilities will be provided through the existing electric service for the existing FEL Building. No major upgrades to existing site services are anticipated to support the operation and maintenance of this new building. Existing staff will primarily address the operation and maintenance of this structure and Helios and its support equipment. However, a small increase in staffing is foreseen both to support Helios and its experimental uses and to maintain this and the other new structures.

The proposed 25,000 sq. ft. building site is an area that has new growth pine and grasses and was previously identified as an expansion area for this activity. There is an adjacent storm channel that will be affected and require modification.

2.2.5.1 Helios Operating Parameters

As part of this proposed action, the new Helios machine would be operated at its 700 MeV (million electron volts) average energy to produce synchrotron light beams for experiments and other purposes. Additionally, it would be used simultaneously with the FEL to study the interaction of such light beams with a variety of materials for fundamental research purposes. The FEL may be modified to accommodate Helios, but no changes in FEL operating levels are identified in this EA. The proposed maximum operating levels of the Helios accelerator are presented in Table 1.

Table 1 Helios Operating Parameters

Parameter	Proposed Operating Level	Maximum Operating Level
Stored Energy[1]	16 joules	32 joules
Beam energy	700 MeV	1000 MeV
Beam current	0.8 Amps[2]	1 Amp

Operating beam current would vary depending on the nature of the experiment or test. The stored energy is the product of the beam power, with a normal range of 500 to 1000 MW (megawatts), and the circumference period of 32 nanoseconds. The circumference period is the time it takes the beam to go once around the machine. In the Helios synchrotron, once generated, this beam is stored at the beginning of a shift, at the energy shown, and typically circulates without interruption or additional intervention for periods of many hours. In addition to the operating constraints established above, before the Helios can be operated, a DOE Accelerator Readiness Review will be performed. Also the Final Safety Assessment Document (FSAD) (SURA 1994) governs accelerator operations at Jefferson Lab. As experience with Helios increases or the need arises, the FSAD may be modified to allow operational changes that are consistent with environmental constraints examined in this EA.

2.2.5.2 Helios Decommissioning

This machine should have an expanded lifetime, as it will operate independently from the FEL. However, as the machine is being installed and operated under this EA, disassembly and reuse or disposal are taken into account. Refer to Section 4.5.1.5 for a discussion of potential impacts from this decommissioning activity.

[1] Stored Energy is the amount of kinetic energy of the particles circulating inside the machine. The hazards from having this small amount of stored energy are minimal. Note if the stored energy is terminated or dissipated, it can only be restored through manual re-injection by the machine operators.

[2] Ampere(s)

2.2.6 Schedule and Labor Requirements

The proposed improvements to Jefferson Lab will be accomplished in phases over the next five or six years. Construction labor required for the improvements would be drawn from the local or regional construction contractor community. There is sufficient capacity to support any or all of these actions.

Jefferson Lab staffing is projected, per the November 2000 Strategic Facilities Plan (SURA 2000), to increase from 611 in FY 00 to a high of 715 in FY 06 tapering off to 667 in FY 11. These numbers are subject to change based on the program needs. The new construction will support the existing staff, users, and facility operations as well as the growing staff and user community.

2.3 NO ACTION

The impact of taking no action on these proposed site improvements on the Jefferson Lab program is described below:

2.3.1 CEBAF Center Additions

If no action is taken on the proposal to put additions on CEBAF Center, the current site buildings will not have sufficient space to accommodate the growing staff and user community. In addition, the present CEBAF Center can not support the expanding computer center needs for storing information and the facility library and document control center will continue to be housed offsite. Office space is currently leased in the City of Newport News Applied Research Center (ARC), which accommodates some staff, and additional space is currently requested in the City's planned Technology Growth Building (TGB). The computer center is currently located in CEBAF Center; however, it needs a substantial increase in space to support both the Jefferson Lab's administrative operating needs and physics program demands. The majority of the computer center staff is currently located in a trailer complex called Trailer City (Building 16), a short walk from CEBAF Center. Computer Center staff in Building 16 is scheduled to relocate further away from the computer center when the TGB is completed strictly due to the lack of space on the Jefferson Lab site. No action would prevent the currently planned collocation of staff presently located in ARC and proposed TGB into CEBAF Center as described by the Jefferson Lab FY 2000 Strategic Facilities Plan (SURA 2000).

As a matter of practice, consolidation of functions and space in both existing and future facilities were reviewed. As identified, underutilized space is reallocated for high priority uses. Space standards are being put in place. Part time staff and users already share space and desks.

2.3.2 End Station Refrigeration Support Building

If no action is taken on the proposal to add a new end station refrigeration support structure, proposals for future physics experiments will be limited due to the lack of cryogenic system capacity. There is a continuous and increasing load on the existing cryogenic support systems. The current arrangements do not enable a more methodical maintenance program that allows sections to be shut down in turn to improve operations. A new building would allow these improved maintenance opportunities and a place to locate a new refrigerator to increase system capacity.

2.3.3 Technical Support Building

If no action is taken on the proposal to build a new Technical Support Building, the already insufficient space required to adequately house Jefferson Lab technical staff, that support the current and planned scientific programs, will become an important factor in maintaining both CEBAF and the FEL functionality. Some of the technician groups currently planned for moving to this building have shops in trailers (temporary structures) and the equipment and materials, that they regularly use, are kept in separate large storage containers.

This new building will allow consolidation of several functions, which will lead to increased productivity. The space currently occupied by the Cryogenics Fabrication Group in Service Building 98, which would move to the new building, will be reallocated to the Physics Target Group from the Experimental Equipment Lab, Building 90. This new location for the Physics Target Group will be adjacent to the experimental halls (Halls A, B, and C) where the completed targets are used. The vacated space in Building 90 will be reallocated to consolidate other functions. If this building is not built, the groups will still function, however less efficiently.

2.3.4 Accelerator Site Storage Building

If no action were taken on the proposal to construct a new Accelerator Site Storage Building, the facility would continue to use the very ineffective and inefficient shipping containers to store accelerator components and continue leasing offsite storage space. Currently there are at least 64 shipping containers (19,280 sq. ft.) on-site and over 9,000 sq. ft. of offsite leased storage space. Very few of the shipping containers are either heated or cooled and several are in a degraded condition. This alternative will not provide an effective long-term storage strategy. Alternate storage would still be required to replace the deteriorating containers.

2.3.5 FEL Addition

If no action were taken on the proposal to construct the addition to the FEL building, researchers would be denied the extra laboratory space for the FEL that is crucial to accommodate the growing user group in that facility. The six existing laboratories are already fully occupied and new requests are being received every week. It is important for basic materials research that the FEL supply the capabilities required of a cutting edge international research institution.

In addition, there will not be sufficient space in any existing on-site buildings to accommodate the operation of the Helios synchrotron light source for research. Not only will the materials research community be denied an important fundamental scientific capability but also it would put at risk research in advanced semiconductor fabrication in this country. The only other existing facility in the country with a lithography source such as this is in a small university environment and cannot accommodate the wide range of research activities possible in an extensive DOE research facility. Substantial research activities could not be performed in this country and some researchers would be forced to perform their research in Japan or elsewhere with those countries gaining the benefits that accrue from potential discoveries.

2.3.6 Helios Operation

With no action, the FEL would continue to operate as already described, but the physics community would miss out on the opportunity for interaction of the present FEL with the new synchrotron light source and its capabilities. The synergy between the operation of the FEL and the synchrotron provides research opportunities for a class of experiments called pump/probe which utilize first a pulse of light from one of the sources followed a short time later by a pulse from the other source. This is a very productive area of research, which is unavailable elsewhere in the world in this set of wavelength ranges. The international community would be denied an entire branch of materials research capability if such a facility were not constructed.

The materials research planned for the synergistic operation of this facility with the FEL will provide a heretofore-unavailable set of applied research capabilities. Substantial sets of materials (metals, crystals, semiconductors, and glasses) exhibit surface functionality changes under the influence of IR and UV light, which can be probed by the light pulses produced by the synchrotron. This pump/probe capability will be unique to Jefferson Lab.

In addition, the lithography research planned for this facility can only be performed at one other facility in the US, CAMD (Center for Advanced Microstructures and Devices) in Baton Rouge, Louisiana. Other countries are pursuing such research into higher computer chip densities and if such research uncovers successful approaches to densification, the U.S. may lose its lead as a primary developer of semiconductor processors. It is important for the future of the U.S. economy to maintain several independent research efforts into this important commercial arena.

2.4 ALTERNATIVES DISMISSED FROM CONSIDERATION

2.4.1 CEBAF Center Additions

The other alternative solutions that exist are to continue to lease the existing City of Newport News space adjacent to the Jefferson Lab site and to sign new leases for additional space elsewhere offsite to accommodate the growing program requirements. Continuing to lease City space adjacent to the site is more costly than building and operating DOE owned space. It is less efficient for personnel when they are not collocated. Inadequate space exists in the currently used City building to accommodate most of the CEBAF Center additions' intended functions. Leasing elsewhere offsite would be too inefficient and disruptive in the day-to-day operation and unduly restrict the Lab's collaborative research effort. It would not offer the long-term cost savings of owning the building as compared to leasing.

Two alternative sites were considered. The first is a wooded site east of Trailer City (Building 16) and west of Rattley Road. The second is a site south of the SURA Residence Facility and east of the Building 90 parking lot. Both sites were rejected in lieu of the preferred site due to function, proximity of staff, and cost of a new site versus expansion of an existing footprint. Collocation of office and associated support functions in the same area was felt to be of primary importance. CEBAF Center was designed with expansion in mind. Overall expansion of CEBAF Center would disturb less land and better utilize the current utility infrastructure.

2.4.2 End Station Refrigeration Support Building

The other alternative considered was to expand the Central Helium Liquefier (CHL) Plant, Building 8. The primary customer for the cryogens to be provided by the equipment in the new building is the experimental program in the end stations. In addition to transfer line and piping costs from the CHL negating any construction savings, the existing available space at the CHL is reserved for an addition to support a future upgrade to 12 GeV in the CEBAF accelerator. Thus, there is insufficient room at the CHL to support the end stations. The primary reason for having the refrigeration system near the end stations is to keep power losses from transporting the extra cryogens from the refrigerator to the experimental halls to a minimum. The existing refrigerator building that supports the end stations has already reached full capacity and other existing refrigerator buildings are too far removed from the end stations to be of service in a cost effective and efficient manner.

2.4.3 Technical Support Building

Another alternative considered was to lease additional space offsite. The functions involved are long term. Leasing offsite would be more costly and inefficient, as the groups would need to transport their support materials back and forth to the Jefferson Lab site.

An alternate site that was considered on the accelerator site was located adjacent to Building 89 and across the street from the CHL and the FEL Building. This site was rejected due to limited available access to the shop and it was felt the amount of paved area could be reduced if collocated to the proposed storage building. Another consideration was a proposed location just outside the tunnel road thus reducing the impact of loading and unloading on regular site traffic. This was rejected as collocation with the proposed storage building was considered to be more efficient use of the area.

2.4.4 Accelerator Site Storage Building

Other alternatives considered were to lease additional space off the site and obtain additional storage containers. Leasing additional space off the site does not correct the situation and the removal of all on-site- storage is impractical. Leasing additional space offsite will cost more over the mid and long term not only due to increasing lease costs but also to the travel time to access the material. Additional storage containers would in effect use more land area due to the inefficient nature of this storage method and cost more money over time to maintain the storage containers in good condition.

Alternate sites considered for the building were in the wooded area north of the accelerator site, an undisturbed area, and one east of Building 54 in a fairly congested area. The first site was rejected due to the higher development cost. The second site was rejected due to the potential congestion, poor accessibility from offsite, and drainage considerations.

2.4.5 FEL Addition

There are no alternative locations at Jefferson Lab or at other facilities that could accommodate the Helios machine and permit its capabilities for research into pump/probe. No building has sufficient space to operate the Helios or provide the radiation shielding required during injection. Even if that were available, no space on the Jefferson Lab site has sufficient area available to install the required instrumentation and perform the photolithography research planned for that machine. Inaction would prevent the utilization of the research tools available with Helios and further crowd the existing FEL support and research areas. The only other possible building location is very near the chosen site to the east of the FEL and offers higher cost and larger environmental impact for a reduced capability. The proposed addition is a modest and cost-effective way to enhance the U.S. research capability in this area and no realistic alternatives are available.

2.4.6 Helios Operation

There are currently no other alternatives for use of the Helios at this time. DOE has no other existing research tool such as the Helios accelerator that could be as easily modified to perform at the operating levels proposed by this action. The synergy between the operation of the FEL and the synchrotron will provide pump-probe research opportunities, which is unavailable elsewhere in the world in this set of wavelength ranges. In addition, the lithography research planned for Helios itself can only be performed at one other facility in the US, the CAMD facility in Louisiana. However, by integrating the functionality of the FEL and Helios, no other existing facility could provide the research opportunities that would open up at Jefferson Lab. Other countries are pursuing such research into higher computer chip densities and if such research uncovers successful approaches to densification the U.S. may lose its lead as a primary developer of semiconductor processors. It is important for the future of the U.S. economy to maintain several independent research efforts into this important commercial arena. To duplicate this capability anywhere else would be substantially more expensive and require similar levels or greater impact at those locations.

Intentionally Left Blank